Syllabus for Math 2346.02: Math for EE and CE Spring 2014
MAGC 1.208 MW 13:10-14:25

Contact information

Instructor: Dr. Eleftherios Gkioulekas, Department of Mathematics
E-mail: drlf@hushmail.com
Web: http://faculty.utpa.edu/gkioulekase/index.html
Office hours: MWR 15:00-16:00
Office location: MAGC 3.214

Course information

Prerequisites: CSCI 1380 or CMPE 1370 or CSCI 1370 with a grade of C or better, and MATH 1460 with a grade of C or better.
Corequisites: None.
Course Description: This course covers the essentials of matrix theory, graph theory, numerical methods, and introduction to proofs needed for majors in Electrical and Computer Engineering. Topics include Gauss-Jordan elimination, matrix algebra, determinants, graphs, trees, root finding algorithms, numerical differentiation, numerical integration, numerical matrix methods, propositional and predicate logic, and formal logic proofs.

References

E. Gkioulekas (2009): "Lecture Notes on Mathematics for Electrical Engineers", 268 pp. (textbook)

See course website for hyperlinks.

Outline of Topics

- **Brief introduction to logic and sets**
  Propositions and sets
  Predicates and quantified statements
- **Linear Algebra**
  Matrices
  Basic operations with matrices
  Matrix multiplication
  Matrix inverses
  Matrix transpose
  Determinants
  Cofactor expansion of determinants
  Simplification of determinants
  $n \times n$ linear systems of equations
    Matrix inverse
    Cramer's rule
    Gaussian elimination
- **Graph theory. Part I**
  Graphs – Basic terminology
  Types of graphs
  Relations between graphs
  Subgraphs
  Graph operations
  Connected graphs
  The Laplacian matrix
  Graph connectivity
  Eulerian graphs
  Hamiltonian graphs
- **Eigenvalues and eigenvectors**
  Definitions
  How to find the eigenvalues
  How to find the eigenvectors
  Characteristic polynomial
  Cayley-Hamilton theorem
- **Graph theory. Part II**
  Adjacency matrix
  Shortest path problem

Trees
Minimum spanning tree problem (Kruskal's algorithm)
Planar graphs

- **Applications of linear systems**
  DC Circuits
  Superposition principle of circuits
  Least squares fit
- **Misc topics**
  Root finding algorithms
  Finite differences
  Integral approximations

Pedagogical objectives and expectations

The fundamental pedagogical objectives that students should strive for in every Mathematics course are:

(1) To understand, learn, and remember the formal and rigorous mathematical *definition* for every concept covered in the course.
(2) To understand, learn, and remember all the *theorems* and *propositions* that are applicable to previously defined concepts.
(3) To understand, learn, and practice the *methods* for applying theorems in the solution of routine problems, and to be able to creatively synthesize techniques to solve problems that are non-routine and may require creative thinking.
(4) To master *rigorous mathematical writing*, understand and use *logic and quantifier notation*, and realize and appreciate that every mathematical argument, from basic arithmetic, to advanced mathematics, with almost no exceptions, is a mathematical proof.
(5) To master the course material to a level of excellence that will ensure sustained success in more advanced mathematics courses.

To be successful in this course, it is expected that you should:

(1) Spend about 12 hours each week working homework problems, reviewing lecture notes, reading the textbook and online lecture notes, studying for exams, and seeking help from the tutors and instructor;
(2) Complete all homework problems, check the correctness of your work, and understand the methods and principles they illustrate;
(3) Master the designed course topics before each quiz and test, and if necessary, complete additional problems beyond those assigned and consult other sources if you find the assigned problems and text are insufficient;
(4) Recognize that mastery of the solution to a problem is not demonstrated by simply obtaining the correct numerical answer, but only by a clear, systematic, and detailed solution that traces the given information to the final numerical answer and that employs knowledge developed in this and previous courses;
(5) When you experience difficulty in the course, seek help from the tutors and instructor immediately;
(6) Attend class meetings regularly, pay attention, and do not hesitate to ask questions; and
(7) Write your solutions to homework, test, and quiz problems in an organized and legible way.

Grading Policies

- **Grading:** There will be 3 major exams, and a comprehensive final exam. The time and location of exams will be announced in class. Exams count for 60% and final exam for 20%. There will also be 10min quizzes accounting for 20% of your grade.Combined, you get a numerical grade on a scale 0-20. Each exam question is graded on a 0-4 scale with $4 = A$, $3 = B$, $2 = C$, $1 = D$,

$0 = F$. Combining all exams, as explained above, gives a weighted average score on a 0-20 scale. This score is then mapped to a letter grade as follows: A: 16-20; B: 12-16; C:10-12; D; 7-10; F: 0-7. There will be no curve and no extra credit.

- **Homework:** Homework will be assigned, but will not be collected or graded. Nevertheless, it is crucial to do the homework as part of your preparation for the exams. To keep up, I recommend that **after every lecture you should solve the homework problems corresponding to the material covered on that day's lecture. Thus you need to work on a continuous basis!** Maintain a well-organized written record of your homework solutions by **writing the statement of each problem** (so that your document is stand-alone and can be read by itself), followed by your detailed solution, and clearly indicate the problem, section, and chapter number of the question. Most homework problems require more than simply writing the answer, and so you must write all steps of your solution and provide appropriate justification, as illustrated by the instructor's solved examples, as you would on a test or quiz. Write neatly and legibly, using rigorous mathematical notation. While you are encouraged to discuss homework problems with other students, tutors, your instructor, and other faculty, the write-up of your solutions must be your own work and not simply copied from another student or another source. Use a ring binder to collect your homework, and write with a black pen, as that will help you to later scan the ring binder as a PDF file, for possible future use, and as a form of backup. This will provide you with a readily available resource to prepare for tests and quizzes, as well as providing documentation of the homework problems should you have a question about a problem and seek help from the instructor or a tutor.
- **Attendance Policy:** Attendance will be taken during most class meetings. It is important to sign in the sign-up sheet if you are present. **The instructor has the prerogative to drop any student with four (4) or more unexcused absenses.** Two (2) tardies will count as one (1) unexcused absense. A tardy is defined as entering the class late or leaving the class early. **If you miss any major exam (e.g. any 50min or longer in-class exam), you will be dropped from the course.**
- **How to Excuse an Absense:** To excuse an absense, you must submit **in writing** the "Notification of a Scheduled Excused Absense form" stapled **with documentation**, before the date you will be absent, or no more than **three (3)** bussiness days after the date. The form should be submitted in person in class, during office hours, or via the Mathematics Department secretary. The form can be downloaded from the course web page. If a major exam is missed during an excused absense, your score for that exam will be replaced with your final exam score.
- **Reinstatement:** Students who are dropped from the course can be recommended for reinstatement only under very extraordinary circumstances, subject to approval by the Department Chair. In general, I will refuse to reinstate students with more than 7 absebses.
- **Make-ups:** There are no make-up exams. In the case of **excused** absences the final exam will be used as a make-up exam. **Each student MUST take the final exam at the scheduled date and time.** There will be no make-ups for the final exam, after the official final exam date!
- **Regrading policy:** If you believe that a mistake in grading has been made you may request that your paper be regraded. Such request must be submitted **in writing** within one week from the day the graded test has been returned in class, and must be accompanied by the original (unaltered) paper. If you make any changes to the paper your request will be denied. Please note that if you request regrading, all problems are subject to review. Thus, your overall grade may be increased or decreased.

Explanation of grades

Your exams are graded question by question on a 0-4 scale per question. Overall, if you are planning to take future Mathematics or STEM courses, I would like to see you score 3 or 4 on all questions on all major examinations. If you score less than that on any questions, it indicates weaknesses in understanding the material. You should be proactive about addressing these weaknesses. Your overall grade is obtained via a simple numerical average of your major examinations and your final examination.

Other Policies

- **Course web page:** A course web page will be used to distribute the syllabus, assigned homework, solutions to exams, a copy of my lecture notes, and any other relevant material. A link to that page will be available from my main page at `http://faculty.utpa.edu/gkioulekase/index.html`
- **Exam pick-up:** If you do not pick up your test paper within 1 week from the test date, I will throw away your paper and keep record of your test score.
- **Extra Help:** You can get additional help during my office hours or from the following locations:
  (1) The *LSAMP Math Lab* is located in room MAGC 3.510 of the Math building. All undergraduate math courses are tutored.
  (2) *The Math Learning Center* is located in the LEAC building (the old Math building), room 114. Courses tutored are: MATH 1300; MATH 1334; MATH 1340; MATH 1341; MATH 1342; MATH 1450; MATH 1460; MATH 1470.
- **Departmental Calculator Policy:** A calculator capable of performing basic scientific computations (arithmetic, trigonometric functions, logarithmic and exponential functions) is required for this course. Graphing calculators, calculators that can store formulas or strings, or calculators capable of performing symbolic calculations will not be allowed in quizzes/tests/exams. Electronic equipments such as pocket organizers, handheld or laptop computers, electronic writing pads or pen-input devices, and cell phones will not be permitted during quizzes and exams. Graphing calculators will be permitted for solving homework problems.
- **More about Calculator Usage:** The problems you will encounter in my exams will not require a calculator, and you are better served in the long-term by minimizing your dependence on calculators. Don't use the calculator to approximate roots, exponentials, logarithms, etc. Mathematical problems require **exact** answers. Approximations are reasonable **only** on application problems where the numbers given may be approximate themselves, and thus the best answer that can be deduced is unavoidably approximate.
- **Classroom Conduct:** Common courtesy requires that students arrive in class on time, and stay the entire class period. Turn your cellphones and pagers off. You are required to treat your classmate and instructor with respect and courtesy. Use of any electronic devices, except for calculators, is not allowed in class, and I reserve the option to remove you from the classroom without warning for any behaviour that I deem as disrespectful or disruptive. You agree to indemnify and hold harmless the professor with respect to all actions undertaken by the professor to enforce classroom conduct or to properly proctor exams.Taking my course implies your consent to this policy.
- **Revisions:** This syllabus may be revised at any time. The syllabus posted on the professor's course web site is the only copy guaranteed to incorporate all revisions that may be made under this policy and will thus supersede any other versions posted on other university websites.

- **Mandatory Course Evaluations:** Students are required to complete an ONLINE evaluation of this course, accessed through ASSIST via your UTPA account (https://my.utpa.edu/); you will be contacted through email and ASSIST on April 9 with further instructions. The evaluation window closes at 11:59pm on April 30, the last day of classes. Students who complete their evaluations by August 13th will have priority access to their grades.
- **Disability Access Statement:** Students with disabilities are encouraged to contact the Disability Services Office for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Texas-Pan American to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Disability Services office (DS), University Center # UC 108 (on the first floor), 665-7005, disabilityservices@utpa.edu. The Director of Disabilities is Christine Stuart-Carruthers, 665-5375, carruthers@utpa.edu.
- **Academic integrity:** As members of a community dedicated to honesty, integrity, and mutual respect in all interactions and relationships, the students, faculty and administration of our university pledge to abide by the principles in The Bronc Honor Code. See: http://www.utpa.edu/dos

About your Professor

Dr. Gkioulekas was raised in a small mining village, Stratonion, in Greece. He was inspired into a teaching career by the example of his High School Mathematics Teacher, Alexandros Pistofides, and by independently studying all three volumes of the *Feynman Lectures on Physics* during the last 4 years of High School. He graduated with a B.Sc. in Applied Mathematics from the California Institute of Technology in 1997, a M.Sc. in 2000 and a Ph.D in Applied Mathematics in 2006, both from the University of Washington.

Dr. Gkioulekas has conducted original research and published many research papers in national and international refereed research journals in Applied Mathematics and Mathematics Education, with specializations in hydrodynamic and geophysical turbulence, statistical mechanics, and curriculum innovations. He has presented his research in many national and international research conferences, research colloquia and research seminars, including research presentations at the Los Alamos National Laboratory, National Center for Atmospheric Science, and the California Institute of Technology.

He has also authored more than 2000 pages of Online Lecture Notes for many undergraduate and graduate courses that are made freely available to the general public via his faculty web page, and continues to develop notes for new courses and improve the existing notes for current courses, as time allows.

Student Learning Outcomes

After completing this course students will be able to

(1) Perform the basic operations of matrix algebra.
(2) Solve a system of linear equations using Gauss-Jordan elimination, including augmented matrices and elementary row operations.
(3) Compute matrix inverses when they exist and solve linear systems using matrix inverses where applicable.
(4) Compute determinants of square matrices using the definition, elementary row operations, and cofactor expansion, know the basic properties of determinants, and solve linear systems using Cramer's rule where applicable.

(5) Compute eigenvalues and eigenvectors of a square matrix and apply them to problems in engineering, mathematics, and science.
(6) Know graph terminology, graph connectivity, Euler and Hamilton paths, planar graphs, and some of the major problems of graph theory, such as shortest path problems (solved by Dijkstra's algorithm).
(7) Understand trees, traversals of trees, sorting, and minimal spanning trees (Prim's and Kruskal's algorithms).
(8) Find roots of functions using the bisection, fixed-point, secant, and Newton's methods.
(9) Approximate derivatives of functions using finite differences.
(10) Approximate integrals using midpoint, trapezoid, and Simpson's rules.
(11) Apply formal methods of symbolic propositional and predicate logic.
(12) Know how to use formal logic proofs and logical reasoning to solve problems.
(13) Understand various proof techniques and determine which type of proof is best for a given problem.